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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/798,908	03/11/2004	Toshiharu Furukawa	ROC920030389US1	6993

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EXAMINER	
ROSASCO, STEPHEN D	
ART UNIT	PAPER NUMBER
1756	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/20/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/798,908	FURUKAWA ET AL.	
	Examiner	Art Unit	
	Stephen Rosasco	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *37-48* is/are allowed.

6)☒ Claim(s) *1-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/11/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

Claims 37-48 - The following is an examiner's statement of reasons for allowance: the claimed invention is distinguished over the prior art of record in that the prior art does not teach the structure as recited in claims 37- 42 comprising a handle substrate, a mask blank, and a layer of a phase shift mask material disposed between said handle substrate and said mask blank; and wherein said handle substrate is silicon and said phase shift mask material is silicon oxide grown by oxidizing said handle substrate; and claim 43-48 which recite an alternating phase shift mask comprising a layer of a phase shift mask material disposed on a first surface of a mask blank, said layer including a second surface and a fused interface joining said first surface of said mask blank with said second surface of said layer.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thony et al. (2005/0158634) in view of Nguyen et al. (6,048,652) or Chou et al. (2002/0195673) and Reinberg (5,460,908).

The claimed invention is directed to a method of fabricating an alternating phase shift mask, comprising: forming a layer of a phase shift mask material on a handle substrate; patterning the layer to form a plurality of phase shift windows in the phase shift mask material; and transferring the patterned layer from the handle substrate to a mask blank to construct the alternating phase shift mask.

The applicant discusses the limitations of the prior art in that the optical path length difference is created by recessing phase shift windows in a blank of the transparent mask material to a depth proportional to the source wavelength and inversely proportional to the refractive index of the mask material. The mask blank is typically fabricated by patterning a layer of an opaque material deposited on the mask blank and then providing recessed phase shift windows in the unmasked areas of the patterned opaque layer by reactive ion etching (RIE).

The fabrication of altPSM's is limited by the uniformity of the etch process. Specifically, the mask blank lacks an etch stop layer so that the inherent pattern factor and across-wafer substrate spatial variations of the etch rate in the RIE process chamber are reproduced in the mask blank. The variations in etch depth arising from the etch rate variations degrade depth of focus and effectively reduce resolution in the finished altPSM as the phase shift windows have different depths in different regions of the altPSM.

And the applicant further states that what is needed, is a method of fabricating an alternating phase shift mask that forms phase shift windows without directly etching a mask blank.

The applicant further states that by eliminating etching of the mask blank, the uniformity of the depth of the phase shift windows over the entire surface area of the alternating phase shift mask is significantly improved.

Thony et al. teach a photolithography mask including a transparent substrate, the substrate including a first part of the substrate and a second part of the substrate fixed to the first part of the substrate, at least one absorber/phase shifter element being embedded in the substrate, wherein the first part of the substrate is bonded without any added material onto the second part of the substrate.

And wherein it includes a first part of the substrate bonded by molecular bonding on a second part of the substrate.

And wherein at least one absorber/phase shifter element is embedded in each first and second parts of the substrate.

The teachings of Thony et al. differ from those of the applicant in that the applicant teaches (claims 15-17) bonding of the phase shift layer to a mask blank, (claims 9 and 13).

(Claims 15-17) Nguyen et al. teach a method of forming a reflective reticle blank, comprising the steps of: forming a reflective layer over a flat substrate; coupling a low thermal expansion material to the reflective layer; and removing the flat substrate, thereby forming a low-defect reflective layer due to the flatness of the flat substrate and exhibiting minimized distortion during processing due to the low thermal expansion material.

Chou et al. teach a method of low-temperature bonding of two substrates, wherein a first surface of the first substrate has a predetermined pattern to define a bonding layer; and positioning the second substrate in contact with said bonding layer on said first substrate to create a bond between said first substrate and said second substrate at said bonding layer. And then applying at least one of heat and pressure to create said bond between said first substrate and said second substrate at said bonding layer.

Claims 9 and 13 recite wherein said handle substrate is silicon and said phase shift mask material is silicon oxide grown by oxidizing said handle substrate. And wherein said mask blank is formed from quartz and said phase shift mask material is selected from the group consisting of quartz and silicon oxide.

Reinberg teaches (see claims 7 and 22) As silicon, when fully oxidized, produces a film approximately twice the thickness of the original unoxidized layer, an example for producing a thickness that is desirable for many phase shifting applications would be to provide a silicon layer 42 approximately 1,250 angstroms thick, so that when oxidized, the oxidized silicon layer 42' would be approximately 2,500 angstroms thick.

It would have been obvious to one having ordinary skill in the art to take the teachings of Thony et al. and combine them with the teachings of Nguyen et al. or Chou et al. and Reinberg in order to make the claimed invention because it would be obvious to take advantage of these known techniques used in the phase shifting art when modifying a substrate for phase shifting and bonding to other layers with oxidation.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Rosasco
Primary Examiner
Art Unit 1756

S.Rosasco
12/8/06